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EMAIL AND ATTACHED SITE 3 DRAFT PROPOSED PLAN NWS YORKTOWN VA
02/28/2014
CH2M HILL

Marrow, Monica/VBO

From:	Friedmann, William/VBO
Sent:	Friday, February 28, 2014 9:06 PM
To:	Oduwole, Moshood; Smith,Wade
Cc:	Gravette, James CIV NAVFAC; Anderson, Mary/VBO; Sawyer, Stephanie/VBO
Subject:	Site 3 Draft Proposed Plan
Attachments:	Site 3 Draft Proposed Plan.pdf

Good evening,
Past business hours, but I wanted everyone to get the copy of the draft Proposed Plan out to you. I don't have the schedule for your review handy, but will follow up with what we are trying to reach for our schedule. I will have several hard copies of the document that you may have for your agencies.

Have a good weekend.
Bill

CH2MHILL.

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NAVFAC Naval Facilities Engineering Command

Draft Proposed Plan

Site 3
Naval Weapons Station Yorktown
Yorktown, Virginia
February 2014

1. Introduction

This Proposed Plan describes the preferred alternatives for groundwater, surface water and sediment at Environmental Restoration Program (ERP) Site 3, the Group 16 Magazines Landfill, located on Naval Weapons Station (WPNSTA) Yorktown, in Yorktown, Virginia. A No Further Action (NFA) Record of Decision (ROD) was signed for soil at Site 3 in 2006. The preferred alternative for sediment and surface water is NFA. The preferred alternative for groundwater consists of four components: 1) Remediation of trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC) using Enhanced *In-Situ* Bioremediation (EISB) and associated performance monitoring; (2) Monitored Natural Attenuation (MNA) of TCE, cis-1,2-DCE, and VC; 3) Monitoring of arsenic and manganese; and (4) Land Use Controls.

This Proposed Plan also summarizes the remedial alternatives that were evaluated for groundwater and the rationale for the selection of the preferred alternative for groundwater. The NFA alternative for sediment and surface water was selected following completion of the 2012 Remedial Investigation (RI), which demonstrated that these media pose no unacceptable risks to human health or ecological receptors. Because there are no unacceptable risks at the site from exposure to sediment and surface water, evaluation of other remedial action alternatives for these media is not necessary.

This Proposed Plan is issued jointly by the U.S. Navy (Navy), the lead agency for site activities, and the U.S. Environmental Protection Agency (EPA) Region 3, the lead regulatory agency, in consultation with the Virginia Department of Environmental Quality (VDEQ), the support regulatory agency.

This Proposed Plan will be available for public review and comment at the York County Public Library – Yorktown (8500 George Washington Memorial Highway, Yorktown, Virginia 23692, (757) 890-3376) during a 45-day public comment period that includes a public meeting and that fulfills community participation responsibilities required under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The Navy and USEPA Region 3, in consultation with VDEQ, will make the final decision on this plan for Site 3 groundwater after reviewing and considering all information submitted during the 45-day public comment period.

Mark Your Calendar for the Public Comment Period

Public Comment Period
May 5, 2014 to June 18, 2014

Submit Written Comments

The Navy, USEPA, and VDEQ will accept written comments on the Proposed Plan during the public comment period. To submit comments or obtain further information, please refer to the comment page located at the end of this Proposed Plan.

Attend the Public Meeting

May 15, 2014 at 3:30 p.m.

Yorktown Public Library
8500 George Washington Memorial Highway
Yorktown, Virginia
(757) 890-5207

The Navy will hold a public meeting to present and discuss the preferred alternative. Verbal and written comments will also be accepted at this meeting.

Location of Administrative Record File:

http://go.usa.gov/DynG
Internet access is available at the:
Yorktown Public Library
8500 George Washington Memorial Highway, Yorktown, Virginia

In addition to presenting the preferred alternatives for Site 3 surface water, sediment, and groundwater, this Proposed Plan summarizes the findings of previous CERCLA investigations that have been conducted at Site 3 for groundwater. Information documenting all environmental investigations at Site 3 is available to the public in the **Administrative Record (AR)** file for WPNSTA Yorktown which can be accessed at http://go.usa.gov/DynG. Details regarding the dates of the public comment period, the date and time of the public meeting, and the location of the AR are included in the text box entitled "Please Mark Your Calendar" on the first page of this Plan. In addition, a glossary of key terms is provided at the end of this Proposed Plan; terms included in the glossary are identified in bold print the first time they appear.

2. Site Background

Site 3, the Group 16 Magazines Landfill, is a two-acre wooded area behind the former Group 16 Magazines, located in the northern portion of WPNSTA Yorktown, west of Indian Field Creek and south of Site 1 (**Figure 1**). North and south of Site 3 are two unnamed tributaries that lead into Indian Field Creek.

Site 3 is named for its proximity to the former Group 16 Magazines; however, the history of this landfill is unrelated to operations at the Magazines. The site was originally used for sand mining and consisted of one 10-foot deep **borrow pit**. Between 1940 and 1970, Site 3 was operated as a landfill. Approximately 90 tons of waste were disposed of in the borrow pit and reportedly included **solvents**, sludge from boiler cleaning operations, grease trap wastes, Imhoff tank skimmings (containing oil and grease), and animal carcasses. Test pit investigations performed in 1997 confirmed the presence of scrap metal, 55-gallon metal drums, grease, wax, lumber, banding, concrete blocks, plastic sheeting, and other debris. A removal action was completed in 1999 to remove the waste and contaminated soil from Site 3. A ROD was signed in 1999 documenting that soil posed no unacceptable risk from unlimited exposure and unrestricted use, therefore no further action was necessary for Site 3 soil. The 2012 RI documented no unacceptable risk from unlimited use and unrestricted exposure to sediment and surface water, therefore NFA is required for these media as documented in the AR and this Proposed Plan.

2.1 Previous Groundwater Investigations and Actions

Site 3 environmental media have been characterized as part of several investigations since 1984. Detailed information from these investigations is available in the AR for WPNSTA Yorktown, and the pertinent reports are shown in **Table 1**. The investigations related to groundwater, surface water, and sediment at Site 3 are summarized in the paragraphs below.

Initial Assessment Study (NEESA, 1984)

The IAS was conducted to identify sites posing a potential threat to human health or the environment because of prior waste management activities. The IAS concluded that because contaminant migration pathways to groundwater and surface water were present at Site 3, sampling would be required to document the presence of contamination and determine the need for further characterization and/or remediation.

Confirmation Study Round I and II (Dames & Moore, 1986 and 1988)

In 1986 and 1988, groundwater, surface water, and sediment samples were collected at Site 3 to verify the presence or absence of contamination. These investigations indicated that TCE concentrations were above federal **Maximum Contaminant Levels** (MCLs) in groundwater. No further site investigations were recommended in the final Confirmation Study Round II.

Remedial Investigation Interim Report (Versar, 1991)

This report presented no new data, but summarized and evaluated existing data from the Confirmation Studies and, based on these data evaluations, provided recommendations for additional efforts to be conducted to complete an RI. The Interim Report recommended additional investigation activities consisting of groundwater, surface water and sediment sampling, a hydrogeologic investigation, a site boundary survey, and a risk assessment.

Figure 1. Site 3 Location Map

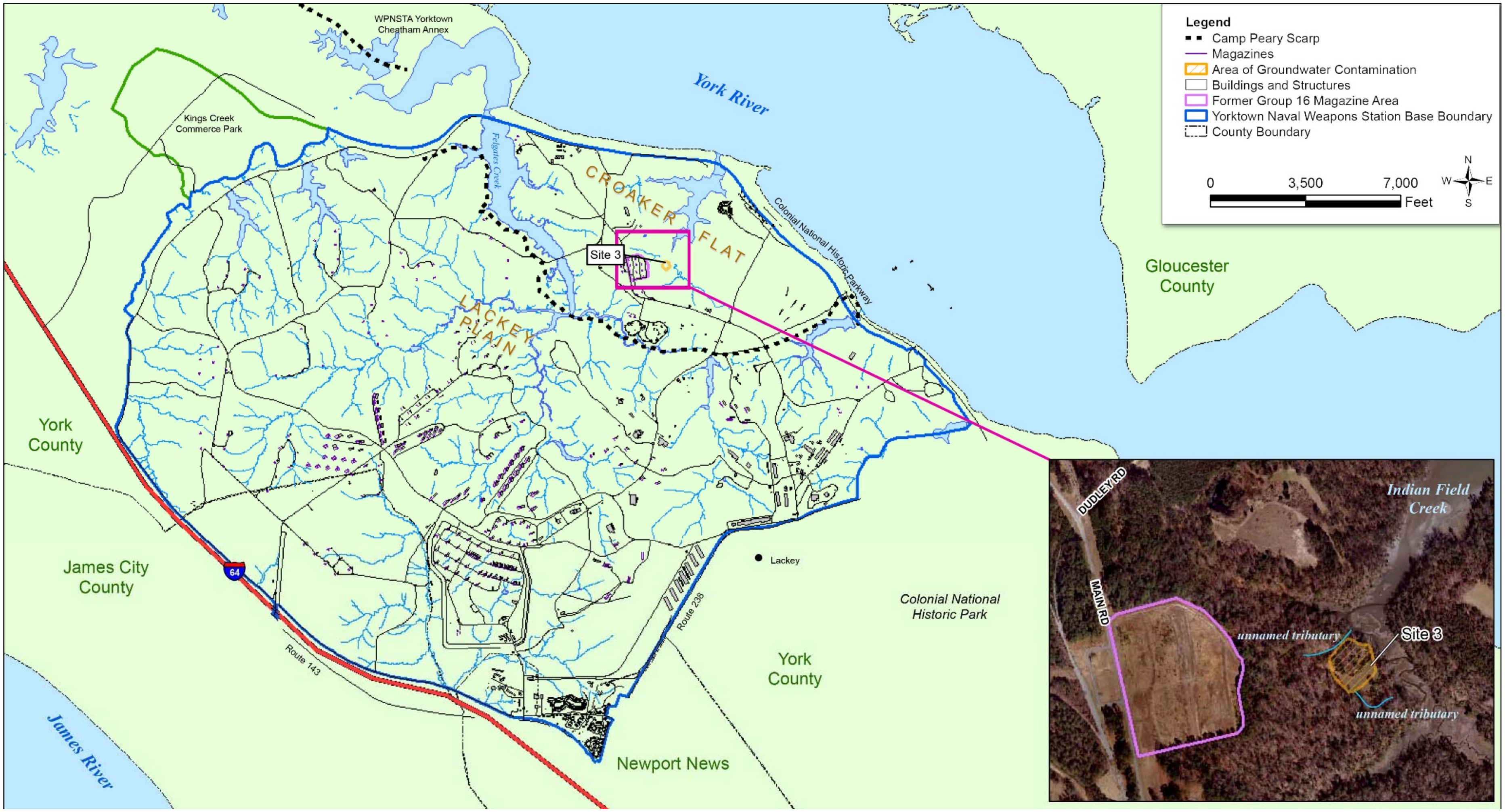


Table 1 - Documents Pertaining to Previous Investigations at Site 3

Document Title/Milestone	Author/Date	AR Document Number
Initial Assessment Study of Naval Supply Center (Norfolk) Cheatham Annex and Yorktown Fuels Division	NEESA, 1984	00247
Confirmation Study Step IA (Verification), Round One, Naval Weapons Station Yorktown	Dames & Moore, 1986	00256 and 00135C
Confirmation Study Step IA (Verification), Round Two, Naval Weapons Station Yorktown	Dames & Moore, 1988	00259
Final Remedial Investigation Interim Report, Fleet and Industrial Supply Center (Norfolk), Cheatham Annex	Versar, 1991	00812
Final Round One Remedial Investigation Report for Sites 1-9, 11, 12, 16-19, and 21, Naval Weapons Station Yorktown	Baker, 1993	00313
Final Round Two Remedial Investigation Report for Sites 1 and 3, Naval Weapons Station Yorktown	Baker, 1997	00998-00999
Final Focused Feasibility Study for Sites 1 and 3, Naval Weapons Station Yorktown	Baker, 1997	01158
Final Record of Decision for Sites 1 and 3, Naval Weapons Station Yorktown	Baker, 1999	01000
Final Remedial Action Report for Sites 1 and 3 and SSA 22, Naval Weapons Station Yorktown	OHM, 2001	01220
Phase I Remedial Investigation Report for Groundwater at Sites 1, 3, 6, 7, 11, 17, 24, and 25, Naval Weapons Station Yorktown	CH2M HILL, 2007	002158
Explanation of Significant Differences for Site 3, Naval Weapons Station Yorktown	CH2M HILL, 2008	002351
Final Phase II Remedial Investigation Report, Sites 1 and 3, Naval Weapons Station Yorktown	CH2M HILL, 2012	002631-002633
Feasibility Study Report for Groundwater at Site 3, Naval Weapons Station Yorktown	CH2M HILL, 2014	Pending

Remedial Investigation – Round One (Baker and Weston, 1993)

Soil, groundwater, surface water, and sediment samples were collected in 1992 during the Round One RI. The results indicated the presence of TCE and other chlorinated volatile organic compounds (VOCs) and metals in groundwater. Metals were also detected in surface soil and sediment. The Round One RI recommended that further groundwater investigation be conducted at Site 3 to evaluate potential seasonal variation of TCE concentrations. It was also recommended that a geophysical investigation be conducted to define the boundaries of waste disposal. Further investigation of surface water or sediment was not recommended.

Remedial Investigation – Round Two (Baker, 1998)

During the Round Two RI, surface soil, subsurface soil, sediment, surface water, and groundwater samples were collected. The results of the Round Two RI indicated the presence of chlorinated VOCs and metals in groundwater, metals in sediment and surface water, and semi-volatile organic compounds (SVOCs) and metals in surface and subsurface soil. The Round Two RI recommended removal of a surface soil SVOC “hot spot” at Site 3 and that land use controls (LUCs) be implemented to restrict the use of groundwater from the Columbia and Yorktown aquifers as a potable water source.

The Navy, in partnership with the USEPA Region 3 and VDEQ, agreed to proceed with evaluating remedial alternatives for soil while an alternatives evaluation for groundwater, surface water and sediment was postponed pending the results of further investigation.

Phase 1 Remedial Investigation (CH2M HILL, 2007)

In 2004, groundwater samples were collected to assess the nature and extent of groundwater contamination. The primary contaminants identified at Site 3 were TCE and its associated biodegradation daughter products. However, the extent of contamination could not be fully defined based on the data that had been collected to date. As a result, it was recommended that membrane interface probe (MIP) and Direct Push Technology (DPT) be used in conjunction with additional groundwater sampling to vertically and horizontally delineate the extent of VOCs in groundwater. In addition, groundwater/ surface water interface sampling was recommended.

Phase 2 Remedial Investigation (CH2M HILL, 2012)

In September 2009, MIP and DPT investigations, groundwater sampling, hydraulic conductivity testing, and surface water, sediment, and sediment pore-water sampling were completed. Results of the Phase 2 RI indicated that VOC contamination was widespread across the site and contributes to unacceptable risk to multiple receptors due to elevated concentrations in groundwater. Manganese and arsenic were also present in groundwater at levels posing unacceptable risks to future residential receptors adjacent to Indian Field Creek, and total petroleum hydrocarbons (TPH) within the diesel range were present in soil between 15 and 19 feet below the ground surface, but do not pose quantifiable human health or ecological risks.

The Phase 2 RI report concluded that remedial action is necessary to address TCE, cis-1,2-DCE VC, arsenic, and manganese in groundwater at the site. No human health or ecological risks were identified for exposure to surface water, sediment, or sediment pore water.

Feasibility Study Report for Groundwater at Site 3 (CH2M HILL, 2014)

The FS evaluated alternatives for remediation of TCE, cis-1,2-DCE, VC, arsenic and manganese present at levels posing unacceptable human health risks in groundwater. The preferred alternative identified in the FS is Alternative 3: Remediation of TCE, cis-1,2-DCE, and VC using EISB and associated performance monitoring; MNA of TCE, cis-1,2-DCE, VC, arsenic and manganese; and LUCs.

3. Site Characteristics

A Conceptual Site Model is a graphical representation of the relevant information available to illustrate what is known about a contaminated site, including site conditions, contaminant distribution, potential receptors, exposure pathways and land use. The Conceptual Site Model for Site 3 is depicted in Figure 2. Site 3 is generally grassy and surrounded by woods. The topography slopes to the northeast, with steeper slopes adjacent to Indian Field Creek and the unnamed tributary to Indian Field Creek. Surface water runoff generally follows the topography and flows toward Indian Field Creek.

The surface geology at Site 3 is lithologically consistent with the Yorktown confining unit. Groundwater is first encountered at the site within the Yorktown-Eastover aquifer, which extends between 20 and 40 feet below the confining unit. The aquifer is confined except in low-lying areas adjacent to the creek, where the Yorktown confining unit is missing. Based on a United States Geological Survey study conducted at WPNSTA Yorktown (Brockman et al., 1997), the Yorktown-Eastover aquifer may be up to 80 feet thick. The Yorktown-Eastover aquifer is underlain by the approximately 100- to 200-foot-thick Eastover-Calvert confining unit. This confining unit was not encountered in the deepest boring at the site, which extended to a depth of approximately 80 feet bgs. Groundwater generally flows eastward towards Indian Field Creek.

There is no current or expected future use of groundwater as a potable water supply at Site 3. Drinking water is supplied to WPNSTA Yorktown and the surrounding area by the City of Newport News Waterworks.

3.1 Nature and Extent of Groundwater Contamination

The VOC plume generally occurs beneath the former landfill area and extends 250 to 300 feet toward Indian Field Creek. The plume is present within the uppermost portion of the Yorktown-Eastover aquifer (top 35 feet). TCE is the most extensive VOC in groundwater. Historically, the highest concentration detected at the site was 860 micrograms per liter (µg/L) at monitoring well GW19 in 1996. During the more recent 2009 Phase II RI sampling event, the maximum concentration of TCE in groundwater was 400 µg/L at GW024, which exceeds both the USEPA tapwater Regional Screening Level (RSL) and the federal MCL (2µg/L and 5 µg/L, respectively). Figure 3 presents the maximum horizontal extent of the VOC plume beneath Site 3.

Figure 2. Conceptual Site Model

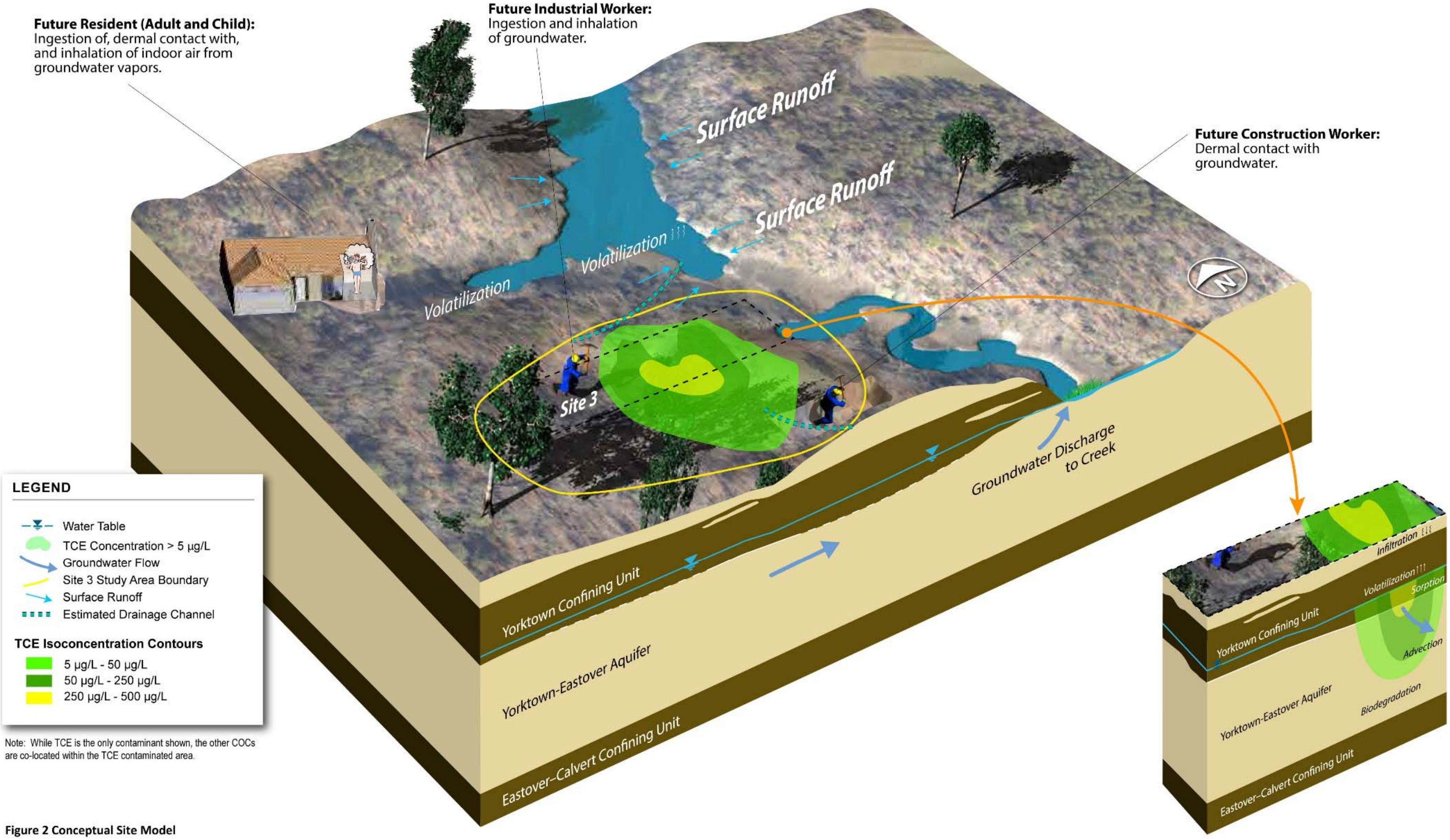
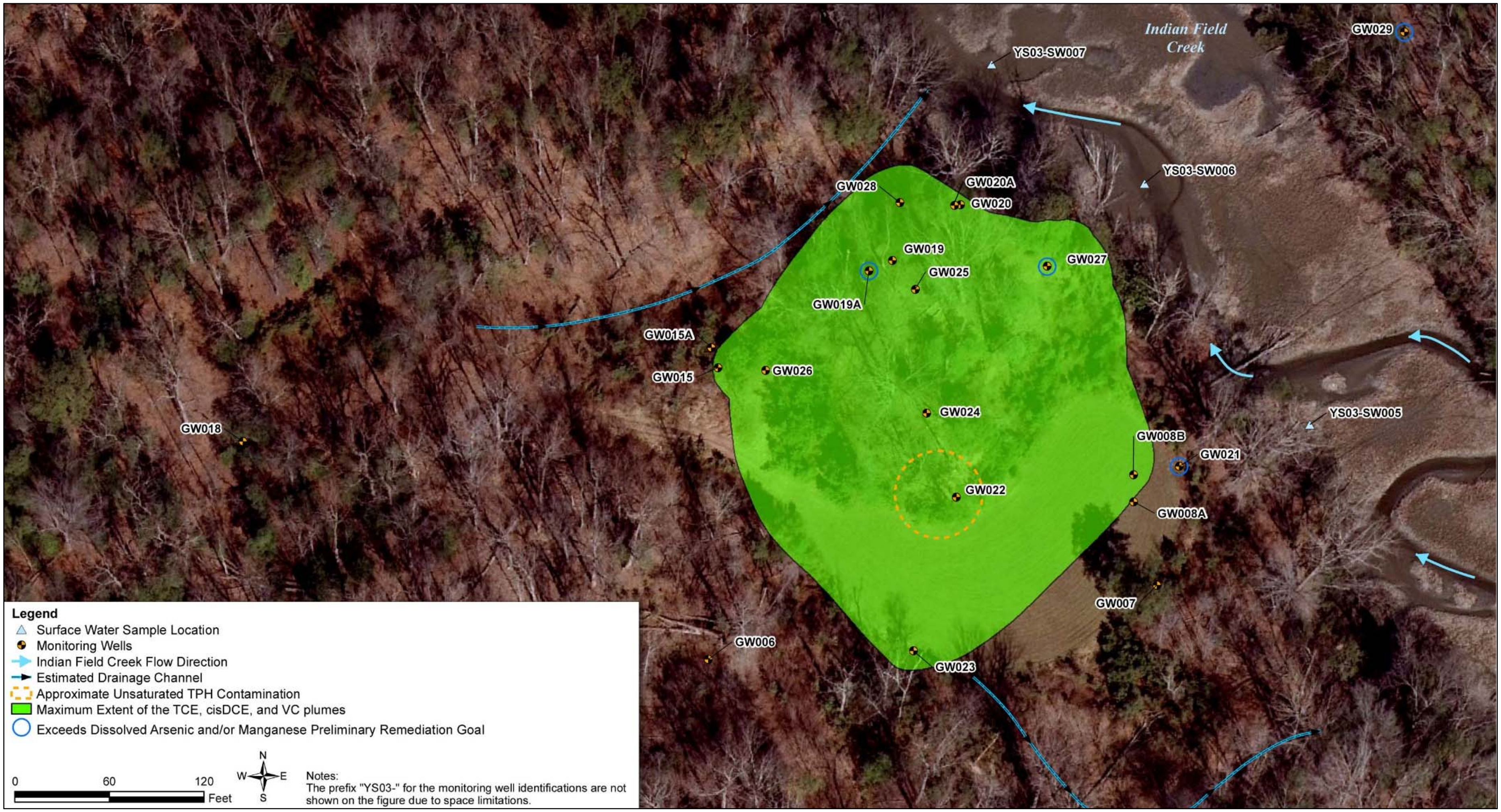


Figure 2 Conceptual Site Model

Figure 3. Groundwater Contamination



Arsenic and manganese were the only metals observed above screening criteria. Dissolved arsenic was detected above its RSL of 0.045 µg/L and MCL of 10 µg/L in two downgradient wells – 34.7 µg/L at GW021 and 25.8 at GW029. GW29 is located on the eastern side of Indian Field Creek, whereas Site 3 is located on the western side of the creek and therefore not influenced by a potential release from Site 3. Because shallow groundwater discharges into the creek, the groundwater flow direction at GW29 is likely to the west towards the creek and the elevated arsenic concentrations are due to reducing conditions near wetlands rather than the result of site activities. Dissolved manganese was detected above 320 milligrams per liter (mg/L), which exceeds the RSL of 88 µg/L , in three downgradient monitoring wells (GW019A, GW021, and GW027); the highest concentration was detected in GW021 at 1,260 µg/L. Two of these monitoring wells were also located close to Indian Field Creek (**Figure 3**) and detections are considered to reflect natural conditions associated with dissolution from aquifer soils under reducing conditions.

Maximum detected groundwater concentrations for constituents of potential concern are provided in **Table 2**.

Table 2 - Maximum Detected Concentrations for Constituents of Concern

VOCs	Concentration (µg/L)
Trichloroethene	400
cis-1,2-Dichloroethene	1,400
Vinyl Chloride	1,200
Metals	**Concentration (µg/L)**
Arsenic (dissolved)	34.7
Manganese (dissolved)	1,260

3.2 Fate and Transport of Contamination

The primary source of contamination at Site 3 was attributed to leaching of contaminants from the buried wastes in the landfill into the subsurface soil and ultimately creating a **dissolved-phase groundwater VOC plume** (TCE, cis-1,2-DCE and VC). The primary mechanism for reductions in chlorinated VOC concentrations under naturally-occurring conditions is degradation. Analytical data indicate that the site exhibits reducing conditions, which are ideal for the biodegradation of chlorinated VOCs. The presence of the TCE biodegradation daughter products cis-1,2-DCE and VC are further evidence that natural biodegradation is occurring at the site. Since all contaminated soil and waste was excavated and disposed of offsite between 1999 and 2000, contaminant concentrations in the shallow groundwater are expected to continue to decrease via natural degradation in the future because no ongoing source is present and there is no potential future release mechanism.

3.3 Principal Threats

"Principal threat wastes" are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should the potential for exposure exist. The contaminated soil and waste has been removed from the site. Contaminated groundwater generally is not considered to be a source material, and the chlorinated VOC concentrations found at Site 3 are not indicative of the presence of **dense non-aqueous phase liquid** (DNAPL). Therefore, the groundwater at Site 3 is not considered to be a principal threat waste.

4. Scope and Role of Response Action

WPNSTA Yorktown was placed on the **National Priorities List** (NPL) in October 1992. A **Federal Facilities Agreement** (FFA), signed in 1994, identified 16 Sites for remedial investigation and 19 site screening areas (SSAs) for the **Site Screening Process** (SSP). Subsequent to the FFA, six additional SSAs were identified for consideration under CERCLA. A summary of how the Navy, in partnership with USEPA Region 3 and VDEQ, is addressing all CERCLA sites at WPNSTA Yorktown is provided in the **Site Management Plan**, which is updated annually and available in the AR file.

The Alternatives for groundwater presented in this Proposed Plan (other than No Action) are intended to mitigate all potential unacceptable risks to human health and the environment from groundwater at Site 3 and is intended to be the final remedy for groundwater at the site. Because there are no unacceptable risk associated with unlimited use and unrestricted exposure to soil, surface water, and sediment at Site 3 as documented in the RI (surface water and sediment) and NFA ROD (soil), a groundwater remedial action represents the final action for Site 3.

5. Summary of Site Risks

It is the judgment of the Navy and USEPA Region 3, in consultation with VDEQ, that a remedial action is necessary to protect human health from actual or threatened exposure to TCE, cis 1,2-DCE, VC, arsenic, and manganese in the shallow groundwater at Site 3. Results of the human health and ecological risk assessments conducted for groundwater at Site 3 are presented in the 2012 RI report and are summarized below. General information regarding how human health and ecological risk evaluations are conducted is provided in text boxes within this section.

A Human Health Risk Assessment (HHRA) evaluated the potential risks for current and future site use (see, "What is Human Health Risk and How is it Calculated?") associated with current and hypothetical future receptors and the scenarios under which they could potentially be exposed to contamination if no remedial action was implemented. Site 3 is located within a restricted area of WPNSTA and is secured with a locked wire gate. In addition, the site is located inside an area encumbered by the Explosives Safety Quantity Distance (ESQD) that limits activities that can be performed within the ESQD. The site is currently open land, used for hunting during the deer and turkey hunting seasons. Based upon current site use and conditions, there are no complete exposure pathways for groundwater at Site 3. Current potential receptors for surface water and sediment are adult and child trespassers who could be exposed through dermal contact or ingestion. The hypothetical future receptors for groundwater are construction and industrial workers, adult and child residents, and lifetime residents. Potential groundwater exposure routes are ingestion; dermal contact; and inhalation, through showering or breathing indoor air. The future residential land use scenario evaluated in this assessment is very conservative because it assumes that land use will change in the future to allow residential development. Even if residential land use occurred, it is unlikely that the Yorktown-Eastover aquifer groundwater would be used as a potable water supply because of the availability of better, existing water supplies with respect to both natural water quality and quantity.

Health risks are based on a conservative estimate of the potential cancer risk and the potential to cause other health effects not related to cancer (non-cancer hazard, or hazard index [HI]). EPA identifies an acceptable cancer risk range of 1 in 10,000 (10^{-4}) to 1 in 1 million (10^{-6}) and a non-cancer hazard as an HI of less than or equal to 1.

TCE, cis-1,2-DCE, VC , arsenic, and manganese were identified as potential human health Chemicals of Concern (COCs) within the Yorktown-Eastover aquifer at Site 3 under future resident, industrial worker, and construction worker exposure scenarios. No potential unacceptable human health risks associated with sediment or surface water were identified.

Using conservative assumptions (Reasonable Maximum Exposure [RME] scenario), the HHRA for Site3 determined that potential risks to future adult and child residents and future industrial workers exposed to groundwater at Site 3 exceeded the acceptable non-carcinogenic hazard index (HI) of 1.0 or the carcinogenic risk range of 10^{-6} to 10^{-4} (Table 3). The future construction worker RME non-carcinogenic hazard associated with exposure to groundwater exceeded the acceptable HI; however, the RME carcinogenic risk (1.7×10^{-5}) is within the acceptable risk range. VOC contamination is widespread across the site and contributes to unacceptable risks to multiple future receptors due to concentrations in groundwater. VOC concentrations in groundwater also exceed MCLs.

An ecological risk assessment (ERA) was also completed as part of the2012 RI report. Surface water, sediment and sediment pore water were evaluated as part of the ERA for Site 3. Groundwater is generally considered only as a transport medium because there are no ecological exposures to groundwater until it discharges to a water body or surfaces as a seep. Therefore, groundwater was considered qualitatively during the ERA, but was not evaluated as an ecologically-relevant medium. Based on the ERA, there are no unacceptable risks to ecological receptors from exposure to surface water, sediment, or sediment pore water at Site 3. Furthermore, none of the primary contaminants in the Site 3 groundwater (TCE, cis-1,2-DCE and VC) were detected in the sediment pore water, surface water, or bulk sediment samples. Based on this evaluation, and since the source area at Site 3 has been removed and groundwater is not a significant continuing source to the aquatic habitats adjacent to this site, the Navy, USEPA Region 3, and VDEQ agreed that Site 3 groundwater does not pose unacceptable ecological risks.

Table 3 - RME Risks and Hazards for Site 3 Groundwater COCs

Receptor	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-6} and <10^{-4}	Chemicals with Cancer Risks >10^{-4}	Hazard Index	Chemicals with HI>0.1 and <1	Chemicals with HI>1
Future Resident Adult	Ingestion	N/A			4.4E+01	Manganese-dissolved	cis-1,2-Dichloroethene, Trichloroethene, Vinyl chloride, Arsenic-dissolved
	Dermal Contact	N/A			4.3E+00	Vinyl chloride	cis-1,2-Dichloroethene, Trichloroethene
	Inhalation /Shower	N/A			7.7E-01	Vinyl chloride	
	Inhalation /Indoor Air	N/A			1.2E+01		Trichloroethene, Vinyl chloride
	Total	N/A			6.1E+01		cis-1,2-Dichloroethene, Trichloroethene, Vinyl chloride, Arsenic-dissolved
Future Resident Child	Ingestion	N/A			1.0E+02	Iron-Dissolved[1]	cis-1,2-Dichloroethene, Trichloroethene, Vinyl chloride, Arsenic-dissolved, Manganese-dissolved
	Dermal Contact	N/A			9.9E+00	Manganese-dissolved	cis-1,2-Dichloroethene, Trichloroethene, Vinyl chloride
	Inhalation /Shower	N/A			1.4E+01		Trichloroethene, Vinyl chloride
	Inhalation /Indoor Air	N/A			5.6E+01		Trichloroethene, Vinyl chloride
	Total	N/A			1.8E+02		cis-1,2-Dichloroethene, Trichloroethene, Vinyl chloride, Arsenic-dissolved, Manganese-dissolved
Future Resident Adult/Child	Ingestion	1.8E-02		Trichloroethene, Vinyl chloride, Arsenic-dissolved	N/A		
	Dermal Contact	3.7E-03	Trichloroethene, Arsenic-dissolved	Vinyl chloride	N/A		
	Inhalation /Shower	3.9E-04	1,1-Dichloroethane, Trichloroethene	Vinyl chloride	N/A		
	Inhalation /Indoor Air	2.5E-03		Vinyl chloride, Trichloroethene	N/A		
	Total	2.4E-02		Trichloroethene, Vinyl chloride, Arsenic-dissolved	N/A		
Future Industrial Worker - Adult	Ingestion	3.0E-03	Trichloroethene	Vinyl chloride, Arsenic-dissolved	1.6E+01	Arsenic-dissolved, Manganese-dissolved	cis-1,2-Dichloroethene, Trichloroethene, Vinyl chloride
	Dermal Contact	N/A			N/A		
	Inhalation /Indoor Air	4.1E-04	Trichloroethene	Vinyl chloride	1.4E+01		Trichloroethene, Vinyl chloride
	Total	3.4E-03		Vinyl chloride	3.0E+01		cis-1,2-Dichloroethene, Trichloroethene, Vinyl chloride
Future Construction Worker - Adult	Ingestion	N/A			N/A		
	Dermal Contact	1.7E-05	Vinyl chloride, Chromium		2.4E+00	Vinyl chloride, Chromium[2], Manganese	Trichloroethene
	Inhalation /Excavation	5.5E-08			4.7E-01	Trichloroethene	
	Total	1.7E-05			2.9E+00		Trichloroethene

[1]Iron is an essential human nutrient and the average daily intake of iron by a child as presented in the HHRAs is below the estimated average requirements for dietary intake.

[2]Chromium poses risk under the construction worker scenario only; however, the total HI for the construction worker non-cancer hazard is 2.9 (RME), individual contribution to the HQ from chromium is 0.3 (RME), and there were no individual target organ HIs greater than 1.0. Consequently, the Navy, in partnership with the USEPA and VDEQ, recommended that no additional action be required to address chromium in groundwater at Site 3 in the Phase II RI.

What is Human Health Risk and How is it Calculated?

A Human Health Risk Assessment (HHRA) estimates the likelihood of health problems occurring if no cleanup action were taken at a site. This is also referred to as "baseline risk." HHRAs are conducted using a stepped process (as outlined in Navy and USEPA HHRA policy and guidance). To estimate baseline risk at a site, the Navy performs the following four-step process:

Step 1: Data Collection and Evaluation
Step 2: Exposure Assessment
Step 3: Toxicity Assessment
Step 4: Risk Characterization

During Data Collection and Evaluation (Step 1), the concentrations of chemicals detected at a site are evaluated, including:

- Identifying and evaluating area(s) where site-related chemicals may be found (source areas) and at what concentrations.
- Evaluating potential movement (transport) of chemicals in the environment.
- Comparing site concentrations to risk-based screening levels to determine which chemicals may pose the greatest threat to human health (called "chemicals of potential concern" [COPCs]). Constituents are not excluded from the risk assessment process if they are within the range of background.

In Step 2, the Exposure Assessment, potential exposures to the COPCs identified in Step 1 are evaluated. This step includes:

- Identifying possible exposure media (for example, soil, air, groundwater, surface water, and/or sediment).
- Evaluating if/how people may be exposed (exposure pathways).
- Evaluating routes of exposure (for example, ingestion).
- Identifying the concentrations of COPCs to which people might be exposed.
- Identifying the potential frequency and length of exposure.
- Calculating a "reasonable maximum exposure" (RME) dose that portrays the highest level of human exposure that could reasonably be expected to occur.

In the Toxicity Assessment (Step 3), both cancer and non-cancer toxicity values are identified for oral, dermal, and inhalation exposures to the COPCs. The toxicity values are identified using the hierarchy of toxicity value sources approved by USEPA.

Step 4 is Risk Characterization, where the information developed in Steps 1-3 is used to estimate potential risk to people. The following approach is used:

- Two types of risk are considered: cancer risk and non-cancer hazard.
- The likelihood of developing cancer as a result of site exposure is expressed as an upper-bound probability; for example, a "1 in 10,000 chance." In other words, for every 10,000 people that might be exposed under the conditions identified in Step 2, one additional case of cancer may occur as a result of site exposure. Unacceptable risk exists when the ELCR of 1×10^{-4} is exceeded.
- For non-cancer health effects, a "hazard index" (HI) is calculated. The HI represents the ratio between the "reference dose," which is the dose at which no adverse health effects are expected to occur, and the RME dose for a person contacting COPCs at the site. The key concept here is that a "threshold level" (measured as a HI of 1) exists below which no non-cancer health effects are expected to occur. The potential risks from the individual COPCs and exposure pathways are summed and a total site risk is calculated for each receptor. The uncertainties associated with the risk estimates are presented and their effects on the conclusions of the HHRA are discussed.

What is Ecological Risk and How is it Calculated?

An ecological risk assessment (ERA) is conceptually similar to a human health risk assessment except that it evaluates the potential risks and impacts to ecological receptors (plants, animals other than humans and domesticated species, habitats [such as wetlands], and communities [groups of interacting plant and animal species]). ERAs are conducted using a tiered, step-wise process (as outlined in Navy and USEPA ERA policy and/or guidance) and are punctuated with Scientific Management Decision Points (SMDPs). SMDPs represent points in the ERA process where agreement among stakeholders on conclusions, actions, or methodologies is needed so that the ERA process can continue (or terminate) in a technically defensible manner. The results of the ERA at a particular SMDP are used to determine how the ERA process should proceed, for example, to the next step in the process or directly to a later step. The process continues until a final decision has been reached (i.e., remedial action if unacceptable risks are identified, or no further action if risks are acceptable). The process can also be iterative if data needs are identified at any step; the needed data are collected and the process starts again at the point appropriate to the type of data collected.

An ERA has three principal components:

1. Problem Formulation establishes the goals, scope, and focus of the ERA and includes:

- Compiling and reviewing existing information on the habitats, plants, and animals that are present on or near the site
- Identifying and evaluating area(s) where site-related chemicals may be found (source areas) and at what concentrations
- Evaluating potential movement (transport) of chemicals in the environment
- Identifying possible exposure media (soil, air, water, sediment)
- Evaluating if/how the plants and animals may be exposed (exposure pathways)
- Evaluating routes of exposure (for example, ingestion)
- Identifying specific receptors (plants and animals) that could be exposed
- Specifying how the risk will be measured (assessment and measurement endpoints) for all complete exposure pathways

2. Risk Analysis which includes:

- Exposure Estimate - An estimate of potential exposures (concentrations of chemicals in applicable media) to plants and animals (receptors). This includes direct exposures of chemicals in site media (such as soil) to lower trophic level receptors (organisms low on the food chain such as plants and insects) and upper trophic level receptors (organisms higher on the food chain such as birds and mammals. This also includes the estimated chemicals dose to upper trophic level receptors via consumption of chemicals accumulated in lower food chain organisms.
- Effects Assessment - The concentrations of chemicals at which an adverse effect may occur are determined.

3. Risk Calculation or Characterization:

- The information developed in the first two steps is used to estimate the potential risk to plants and/or animals b comparing the exposure estimates with the effects threshold.
- Also included is an evaluation of the uncertainties (that is, potential degree of error) associated with the predicted risk estimate and their effects on ERA conclusions.

The three principal components of an ERA are implemented as an 8-step, 3-tier process as follows:

1. Screening-Level ERA (Steps 1-2; Tier 1) – The Screening Level ERA (SLERA) conducts an assessment of ecological risk using the three steps described above and very conservative assumptions (such as using maximum chemical concentrations).
2. Baseline ERA (Steps 3-7; Tier 2) – If potential risks are identified in the SLERA, a Baseline ERA (BERA) is typically conducted. The BERA is a reiteration of the three steps described above but uses more site-specific and realistic exposure assumptions, as well as additional methods not included in the SLERA, such as consideration of background concentrations. The BERA may also include the collection of site-specific data (such as measuring the concentrations of chemicals in the tissues of organisms, for example, fish) to address key risk issues identified in the SLERA.
3. Risk Management (Step 8; Tier 3) – Step 8 develops recommendations on ways to address any unacceptable ecological risks that are identified in the BERA and may also include other activities, such as evaluating remedial alternatives.

6. Remedial Action Objectives

There are no unacceptable risks associated with exposure to surface water or sediment; however, Remedial Action is necessary to protect human health from exposure to the site-related COCs TCE, cis-1,2-DCE, VC, arsenic, and manganese within the groundwater at Site 3. Therefore, the following remedial action objectives (RAOs) were established for Site 3 groundwater:

- Reduce TCE, cis-1,2-DCE, VC, arsenic, and manganese concentrations in groundwater to risk-based cleanup levels
- Prevent future human receptors (resident and industrial worker) exposure to groundwater until risk-based cleanup levels are met
- Prevent unacceptable risk to ecological receptors from exposure to COCs in groundwater that discharges to Indian Field Creek[1]

Remediation goals (RGs) were developed for site-related groundwater COCs that contribute to a potential unacceptable risk to human health under future residential or industrial worker scenarios (Table 4). MCLs are the highest level of a contaminant allowed in drinking water, are considered to be protective, and allow for unlimited use and unrestricted exposure, therefore MCLs were established as the RGs for TCE, cis-1,2-DCE, VC, and arsenic.. Because no MCL has been established for manganese, a risk-based RG was calculated. The RG for manganese was determined based on Remedial Goal Option (RGO) calculations (USEPA, 1991), which incorporate pathways for the ingestion, dermal absorption, and inhalation of volatiles and particulates for future residents and the same exposure assumptions as the HHRA

Table 4 Remediation Goals for COCs in Groundwater at Site 3

Chemical of Concern	Remediation Goal
cis-1,2-Dichloroethene	70 µg/L
Trichloroethene	5 µg/L
Vinyl chloride	2 µg/L
Arsenic, dissolved	10 µg/L
Manganese, dissolved	320 µg/L

7. Summary of Remedial Alternatives

There is NFA required for sediment and surface water because there are no unacceptable risks at the site from exposure to sediment and surface water.

The remedial alternatives developed and evaluated to address COCs in groundwater at Site 3 are detailed in the Feasibility Study (FS). Following the screening of groundwater remediation technologies, the following remedial alternatives were selected for detailed evaluation and comparative analysis:

- Alternative 1 – No Action
- Alternative 2 – Monitored Natural Attenuation (TCE, cis-1,2-DCE, and VC); Monitoring (arsenic and manganese); and land use controls
- Alternative 3 – Enhanced *In-Situ* Bioremediation (TCE, cis-1,2-DCE, and VC); Monitored Natural Attenuation (TCE, cis-1,2-DCE, and VC); Monitoring (arsenic and manganese); and Land Use Controls
- Alternative 4 – *In-Situ* Chemical Reduction (TCE, cis-1,2-DCE, and VC); Monitored Natural Attenuation (TCE, cis-1,2-DCE, and VC); Monitoring (arsenic and manganese); and Land Use Controls
- Alternative 5 – *In-Situ* Chemical Oxidation (TCE, cis-1,2-DCE, and VC); Monitored Natural Attenuation (TCE, cis-1,2-DCE, and VC); Monitoring (arsenic and manganese); and Land Use Controls

[1] Current COC concentrations in groundwater do not pose risk to ecological receptors; however, remedial actions to address VOCs in groundwater can temporarily increase concentrations of metals in groundwater.

Based on the results of the detailed evaluation and comparative analysis, Alternative 3 was selected as the Preferred Alternative for groundwater. With the exception of the no-action alternative (Alternative 1), each of the alternatives includes monitored natural attenuation of TCE, cis-1,2-DCE, and VC, monitoring of arsenic and manganese, and the implementation of LUCs to prevent unacceptable risk exposure. Alternative 1 is required by the NCP and serves as the baseline against which the other alternatives are compared. For Alternatives 2, 3, 4, and 5, monitoring and LUCs would be maintained until the RAOs are met, with 5-year statutory reviews to ensure protection of human health and the environment. A description of each remedial alternative is provided in Table 5.

Elevated concentrations of dissolved arsenic and manganese in groundwater are likely the result of several factors, which may include naturally-occurring reducing conditions near Indian Field Creek, the reducing conditions resulting from TCE, cis-1,2-DCE, and VC contamination in groundwater, and/or low levels of TPH in unsaturated subsurface soils (15-19 feet below ground surface) contributing to reducing conditions but that don't pose a risk to human health or the environment. If it is determined during performance monitoring or LTM that the primary cause of the elevated concentrations of dissolved arsenic and manganese detected in groundwater is a result of the low levels of TPH that remains in deep subsurface soils at the site (i.e., the TPH is acting as a source of carbon that is resulting in mobilizing these metals), a contingency action that includes the removal and off-base disposal of these soils may be implemented.

8. Evaluation of Remedial Alternatives

The NCP identifies nine evaluation criteria for use in a comparative analysis of remedial alternatives (Table 5). Each remedial alternative for Site 3 groundwater was evaluated against these criteria (Table 6) and in comparison to one another. The contingency soil excavation was evaluated against the NCP criteria on its own since it can be added to any of the proposed alternatives. Alternative 1 (no action) does not protect human health and the environment, is not effective in the long term, and does not reduce toxicity, mobility, or volume through treatment. Therefore, Alternative 1 serves only as a baseline.

8.1 Threshold Criteria

Protection of Human Health and the Environment

Alternatives 2, 3, 4, and 5 are all protective of human health and the environment. All four alternatives rely to some degree on MNA to reduce the concentrations of site-related COCs plus LUCs to maintain protectiveness of human health and the environment. The time estimated for each of the four remedial alternatives (not including the No Action alternative) to reach RAOs ranges from 9 years (Alternative 3) to 19 years (Alternative 2). Alternative 2 relies solely on natural attenuation to meet RAOs, whereas Alternatives 3, 4, and 5 engage active treatment technologies (EISB, ISCR, or ISCO) to accelerate the remediation timeframe.

Compliance with Applicable or Relevant and Appropriate Requirements

All alternatives, except for Alternative 1, are expected to comply with ARARs. Alternatives 2 through 5 would all require performance monitoring associated with MNA and LUCs. Alternatives 3 through 5 would also comply with ARARs related to underground injections of reagents and erosion and sediment controls of larger construction areas.

8.2 Primary Balancing Criteria

Long-term Effectiveness and Permanence

Except for Alternative 1, all alternatives are expected to be effective in the long-term and be a permanent means of reducing the concentrations of the COCs. Once RAOs are achieved, all alternatives, except Alternative 1, are expected to have residual risks of the same magnitude. Some residual risk will be apparent because Alternatives 2 through 5 rely on MNA and LUCs. For each alternative, with planning and implementation, the controls put in place would effectively verify continued compliance with RAOs.

Reduction in Toxicity, Mobility, or Volume through Treatment

Alternative 3 is expected to be highly effective at reducing toxicity, mobility, and volume of contamination in groundwater, by treating groundwater over an extensive area. Alternatives 4 and 5 would be moderately effective because they also include active treatment, but over a small area. Alternatives 1 and 2 scored low because active treatment would not be a component of these alternatives, though natural reduction of contaminant concentrations through a variety of physical, chemical, or biological activities is expected to occur over time.

Table 5 - Description of Groundwater Remedial Alternatives for Site 3

Alternative	Components	Details	Cost
Alternative 1	No action	Allow the COCs to breakdown naturally over time.	Capital Cost: $0 O&M Present Value: $0 Total Present Value: $0
Alternative 2	• MNA of TCE, cis-1,2 -DCE, VC • Monitoring of arsenic and manganese • LUCs	Conduct monitoring activities to determine the effectiveness of natural attenuation processes Estimated duration of 19 years Long-term monitoring performed to demonstrate that: • COC concentrations continue to decrease • Potentially toxic transformation products are not created at levels that are a threat to human health • Impacted area is not expanding • There are no changes in hydrogeological, geochemical, or microbiological parameters that might reduce the effectiveness of the Remedial Action LUCs prevent exposure and control changes in site use.	Capital Cost:$13,000 O&M Present Value: $1,104,000 Total Present Value:$1,117,000
Alternative 3	• EISB of TCE, cis-1,2-DCE, and VC using injection of biostimulant and augmentation in areas where concentrations > 50% higher than RGs • MNA for TCE, cis-1,2-DCE, and VC • Monitoring of arsenic and manganese • LUCs	Injection of electron donor and/or microbial cultures will enhance biodegradation of VOCs Estimated duration of 9 years Long-term monitoring performed to demonstrate that: • COC concentrations continue to decrease • Potentially toxic transformation products are not created at levels that are a threat to human health • Impacted area is not expanding • There are no changes in hydrogeological, geochemical, or microbiological parameters that might reduce the effectiveness of the Remedial Action LUCs prevent exposure and control changes in site use.	Capital Cost:$169,000 O&M Present Value: $784,000 Total Present Value: $953,000
Alternative 4	• ISCR of TCE, cis-1,2-DCE, and VC in areas where concentrations > 50% higher than RGs • MNA for TCE, cis-1,2-DCE, and VC • Monitoring of arsenic and manganese • LUCs	Injection of reducing agents into groundwater to accelerate abiotic reduction of VOCs Estimated duration of 11 years Long-term monitoring performed to demonstrate that: • COC concentrations continue to decrease • Potentially toxic transformation products are not created at levels that are a threat to human health • Impacted area is not expanding • There are no changes in hydrogeological, geochemical, or microbiological parameters that might reduce the effectiveness of the Remedial Action LUCs prevent exposure and control changes in site use.	Capital Cost:$479,000 O&M Present Value:$834,000 Total Present Value:$1,313,000
Alternative 5	• ISCO of TCE, cis-1,2-DCE, and VC in areas where concentrations > 50% higher than RGs • MNA for TCE, cis-1,2-DCE, and VC • Monitoring of arsenic and manganese • LUCs	Injection of oxidizing agents to create oxidizing conditions, thereby stabilizing the VOC plume and precipitating manganese and arsenic dissolved in groundwater Estimated duration of 11 years Long-term monitoring performed to demonstrate that: • COC concentrations continue to decrease • Potentially toxic transformation products are not created at levels that are a threat to human health • Impacted area is not expanding • There are no changes in hydrogeological, geochemical, or microbiological parameters that might reduce the effectiveness of the Remedial Action LUCs prevent exposure and control changes in site use.	Capital Cost: $496,000 O&M Present Value: $828,000 Total Present Value: $1,324,000
Contingency Soil Removal	• Excavate TPH-contaminated soil	Removal and offsite disposal of TPH-contaminated soil as a contingency measure to enable attenuation of arsenic and manganese by removing source of organic carbon, which may be facilitating manganese and arsenic dissolution.	Capital Cost: $624,000 O&M Present Value: $0 Total Present Value: $624,000

Table 6- Evaluation Criteria for Groundwater Remedial Alternative Analysis

CERCLA Criteria	Definition
Threshold Criteria	
Protection of Human health and the environment	Addresses whether an alternative provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through mitigation, engineering controls, or institutional controls
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	Addresses whether an alternative will meet all of the ARARs or other federal and state environmental laws and/or justifies a waiver of the requirements
Primary Balancing Criteria	
Long-term effectiveness and permanence	Addresses the expected residual risk and the ability of an alternative to maintain reliable protection of human health and the environment over time, once clean-up goals have been met
Reduction in toxicity, mobility, or volume through treatment	Discusses the anticipated performance of the treatment technologies an alternative may employ
Short-term effectiveness	Considers the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved
Implementability	Evaluates the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement an option
Present-worth cost	Compares the estimated initial, operations and maintenance, and present-worth costs
Modifying Criteria	
State acceptance	Considers the state agency comments on the Proposed Plan
Community acceptance	Provides the public's general response to the remedial alternatives described in the Proposed Plan, RI report, and the FS report. The specific responses to the public comments are addressed in the "Responsiveness Summary" section of the ROD.

Short-Term Effectiveness

Alternatives 1 and 2 are considered highly effective in the short term because they would minimally affect the community, workers, or the local environment, as the site would not be changed from current conditions. The short-term effectiveness associated with Alternatives 3, 4, and 5 is moderate. Alternatives 3, 4, and 5 all rely on direct injection technology for implementation, therefore the community, site workers, and environment would be impacted due to construction activities, reagent injections, waste generation, and a high volume of vehicle traffic (transport of materials, equipment, and workers to the site as well as heavy machinery use during construction).

Implementability

Alternatives 3, 4, and 5 can each be implemented using standard and widely available technologies. These three alternatives (3, 4 and 5) require engineering and construction services, and each alternative requires thorough monitoring to ensure they continue to operate on a path toward achieving RAOs. Each of the three alternatives (3, 4 and 5) is reliable provided they are designed and implemented correctly.

Cost

An order of magnitude (OOM) cost for each alternative was estimated based on assumptions described in the FS. The timeframes required to achieve the RGs vary among the alternatives. Other than the No Action Alternative (Alternative 1), the least-expensive alternative is Alternative 3, with an estimated total present value cost of $953,000. Alternative 2 has a slightly higher estimated present value cost of $1,117,000 due to the longer duration of the alternative. Alternatives 4 and 5 have comparable estimated present-value costs of $1,313,000 and $1,324,000, respectively. Alternative 2 has the lowest total capital cost, estimated at $13,000. Alternatives 3, 4, and 5 have estimated capital costs of $169,000, $479,000, and $496,000, respectively.

Table 7 provides a relative ranking of the five alternatives with respect to the Threshold and Primary Balancing criteria.

Table 7 - Relative Ranking of Groundwater Remedial Alternatives

CERCLA Criteria	Alternative 1 - No Action	Alternative 2 - MNA (TCE, cis-1,2-DCE, and VC); Monitoring (arsenic and manganese); and LUCs	Alternative 3 - EISB (TCE, cis-1,2-DCE, and VC); MNA (TCE, cis-1,2-DCE, and VC); Monitoring (arsenic and manganese); and LUCs	Alternative 4 – *ISCR* (TCE, cis-1,2-DCE, and VC); MNA (TCE, cis-1,2-DCE, and VC); Monitoring (arsenic and manganese); and LUCs	Alternative 5 – *ISCO* (TCE, cis-1,2-DCE, and VC); MNA (TCE, cis-1,2-DCE, and VC); Monitoring (arsenic and manganese); and LUCs
Threshold Criteria					
Protection of human health and the environment	❍	●	●	●	●
Compliance with ARARs	❍	●	●	●	●
Primary Balancing Criteria					
Long-term effectiveness and permanence	❍	●	●	●	●
Reduction in toxicity, mobility, or volume through treatment	❍	❍	●	◉	◉
Short-term effectiveness	●	●	◉	◉	◉
Implementability	●	●	◉	◉	◉
Cost	No cost	◉	❍	●	●

Ranking: ● High ◉ Moderate ❍ Low N/A=Not Applicable

Rankings are provided as qualitative descriptions of the relative compliance of each alternative with the criteria.

8.3 Modifying Criteria

State Acceptance

State involvement has been solicited throughout the CERCLA remedy selection process. The State supports the Preferred Alternatives, NFA for surface water and sediment and Alternative 3 for groundwater. Their final concurrence will be solicited following the review of all comments received during the public comment period.

Community Acceptance

Community acceptance will be evaluated after the public comment period for the Proposed Plan, and public comments will be addressed and documented in the forthcoming Record of Decision (ROD) for Site 3 groundwater, surface water and sediment.

9. Preferred Alternative

No action is necessary for protection of human health and the environment for sediment and surface water because there are no unacceptable risks at the site from exposure to sediment and surface water.

Based on the results of the comparative analysis, the Preferred Alternative for groundwater is Alternative 3. This Alternative is protective of human health and environment and provides the best balance of tradeoffs for effectiveness, implementability, and cost. Alternative 3 has the lowest cost and the shortest estimated timeframe for remediation of 9 years and meets the statutory preference for active treatment as a component of the remedy. In addition, Alternative 3 would be synergistic with natural attenuation processes for TCE, cis-1,2-DCE, and VC and may enhance natural biodegradation in the downgradient portion of the plume.

Further, in accordance with the Navy's vision for Sustaining Our Environment, Alternative 3 was evaluated using the approaches described in the Sustainable Environmental Remediation (NAVFAC, 2009) under each of the NCP Criteria for Site 3. The eight sustainability metrics include: Energy Consumption, GHG Emissions, Criteria Pollutant Emissions, Water Impacts, Ecological Impacts, Resource Consumption, Worker Safety, and Community Impacts. The rankings in the sustainability evaluation for Alternatives 3, 4, and 5 were similar and lower than Alternative 2;

Alternatives 4 and 5 would likely have the highest water consumption and highest air emissions for nitrogen oxides, sulfur oxides, and particulate matter.

Cost versus benefit (such as length of time, sustainability, etc.) comparison indicates that Alternative 3 is the most cost-effective of the alternatives presented to address groundwater. Therefore, Alternative 3 is the preferred alternative for remediation of groundwater contamination at Site 3.

If determined during performance monitoring or LTM that the low levels of TPH, which remain in deep unsaturated soils (15-19 feet below ground surface) and do not themselves pose a risk to human health or the environment, are acting as a carbon source resulting in the mobilization of arsenic and manganese in groundwater, the contingency action (TPH soil removal) may be implemented.

10. Community Participation

The Navy and USEPA Region 3, in consultation with VDEQ, will make the final decision on this approach for Site 3 after reviewing and considering all information and comments submitted during the 45-day public comment period. The public comment period for this Proposed Plan will extend from May 5, 2014 to June 18, 2014 and a public meeting to discuss the Proposed Plan will be held May 15, 2014 from 3:30 p.m. to 4:00 p.m. Details regarding the public comment period and public meeting are included in the text box in Section 1 entitled, "Please Mark Your Calendar." The Navy will summarize and respond to all comments submitted during the public comment period in a responsiveness summary that will be included in the final decision document, the Record of Decision (ROD), which will follow this Proposed Plan. This Proposed Plan and the ROD will become part of the AR file for WPNSTA Yorktown.

Public participation is encouraged since the preferred alternatives presented in this Proposed Plan may be modified or other alternatives selected based on new information and/or public comments received. The public is encouraged to gain a more comprehensive understanding of Site 3 and the Navy's ERP by attending this and other public meetings advertised in the *Daily Press* and *Virginia Gazette* newspapers and by accessing information included in the AR file. Minutes of all public meetings will be included in the file.

Location of Administrative Record and Information Repository

Available online at: http://go.usa.gov/Dy5T

Internet access is available at the:
Yorktown Public Library
8500 George Washington Memorial Highway
Yorktown, Virginia
(757) 890-5207

During the comment period, interested parties may submit written comments to the following address:

Mr. Jim Gravette
NAVFAC Mid-Atlantic
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Norfolk, VA 23511-3095
Phone: (757) 341-0477
Email: James.gravette@navy.mil

Mr. Oduwole Moshood
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Email: Oduwole.moshood@epa.gov

Mr. Wade Smith
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629 East Main Street, 4th Floor
Richmond, VA 23219
Phone: (804) 698-4125
Email: wade.smith@deq.virginia.gov

Glossary

Administrative Record: A compilation of documents relied upon to select a remedial response. The AR is available to the public and is in the ERP Information Repository.

Applicable or Relevant and Appropriate Requirements (ARARs):

- *Applicable requirements*, as defined in 40 CFR § 300.5, are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be applicable.
- *Relevant and appropriate requirements,* as defined in as defined in 40 CFR § 300.5, means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be relevant and appropriate.

Borrow Pit: An area where material (usually soil, gravel or sand) has been dug for use at another location.

Cancer risk: The incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA): A federal law, commonly referred to as the "Superfund" Program, passed in 1980 and amended by the Superfund Amendments and Reauthorization Act of 1986. CERCLA provides for cleanup and emergency response in connection with existing inactive hazardous waste disposal sites that endanger public health and safety or the environment.

Chemical of concern (COC): Specific chemicals that are identified for evaluation in the site assessment process.

Confining unit: A geologic formation that consists of impermeable or distinctly less permeable material bounding one or more aquifers.

Dense non-aqueous Phase Liquid (DNAPL): One of a group of organic substances that are relatively insoluble in water and more dense than water. DNAPLs tend to sink vertically through sand and gravel aquifers to the underlying layer.

Discharge: The location at which groundwater leaves and aquifer and flow to the surface

Dissolved Phase Groundwater VOC Plume: Dissolution of residual DNAPL source under natural conditions.

Ecological risk assessment (ERA): An evaluation of the risk posed to the environment if remedial activities are not performed at the site.

Enhanced In-Situ Bioremediation (EISB): Injecting insoluble or soluble substrates into a media to facilitate biodegradation.

Environmental Restoration Program (ERP): The Navy program charged with implementing environmental cleanups under CERCLA at Navy installations. The Navy, as lead agency, acts in partnership with USEPA Region 3 and VDEQ to address environmental investigations at Navy facilities through the ERP.

Exposure pathways: The pathway a chemical takes from the source of contamination to the exposed individual.

Federal Facility Agreement (FFA): Negotiated agreement that specifies required actions at a federal facility as agreed upon by various agencies (e.g., EPA, RWQCB, DOE).

Geology: Soil and rock that underlie the ground's surface.

Hazard index (HI): Summation of the non-cancer risks to which an individual is exposed. An HI value of 1.0 or less indicates that non-cancer adverse human health effects are unlikely to occur.

Human health risk assessment (HHRA): An organized process used to describe and estimate the likelihood of adverse impacts on human.

Land use controls (LUCs): Physical, legal, or administrative methods that restrict the use of or limits access to real property to manage risks to human health and the environment.

Maximum contaminant level (MCL): Enforceable standards that apply to public water systems, developed by EPA. The highest level of a contaminant that is allowed in drinking water

Monitored natural attenuation (MNA): Reduction in mass or concentration of a compound in groundwater over time or distance from the source of constituents of concern due to naturally occurring physical, chemical, and biological processes, such as; biodegradation, dispersion, dilution, adsorption, and volatilization.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): Provides the organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants.

National Priorities List (NPL): A list developed by USEPA of uncontrolled hazardous substance release sites in the United States that are considered priorities for long-term remedial evaluation and response.

Non-cancer hazard: Probability that a chemical will produce a non-cancer effect in humans. Estimate of this probability is identified as the hazard quotient, the sum of which is identified as the HI.

Principal Threat Wastes: As defined by the NCP, source materials that generally cannot be reliably contained or would present a significant risk to human health or the environment should they be exposed.

Proposed Plan: A document that presents information and requests public input regarding a proposed cleanup alternative.

Reasonable Maximum Exposure (RME): The highest exposure that is reasonably expected to occur at a site. The intent of the RME is to estimate a conservative exposure case (i.e., well above the average case) that is still within the range of possible exposures.

Receptors: Humans, animals, or plants that may be exposed to risks from contaminants related to a given site.

Record of Decision (ROD): A legal document that describes the cleanup action or alternative selected for a site, the basis for choosing that alternative, and public comment on the selected alternative.

Remedial action objectives (RAOs): Specific goals for protecting human health and the environment. They are developed by evaluating ARARs protective of human health and environment and results of remedial investigations and risk assessments.

Remediation Goals (RGs): Clean-up goals developed based on readily available information and include results of the baseline risk assessment. They also are used during analysis of remedial alternatives in the remedial investigation/feasibility study (RI/FS).

Remedial Goal Option (RGO): Incorporate ingestion, dermal absorption, and inhalation of volatiles and particulate pathways for future residents.

Reasonable Maximum Exposure (RME): The maximum exposure reasonably expected to occur in a population, or in different groups within a population (for example, the elderly or children).

Remedial investigation (RI): Extensive technical study conducted to characterize the nature and extent of risks posed by a site.

Sediment: Matter that settles to the bottom of a liquid.

Site Screening Process: Process to determine if an area should be considered a Site for further investigation.

Site Management Plan: Annual document generated in accordance with the Federal Facilities Agreement, which provides a 5-year plan for CERCLA Installation Restoration activities.

Solvent: Materials such as degreasers, cleaners, extractants, and diluents.

Surface Water: A body of water on the surface of the earth.

Unlimited and Unrestricted Exposure: Full use of all environmental media including groundwater, soil, and surface water with no limits placed on the use of the environmental media.

U.S. Environmental Protection Agency (USEPA): The federal agency responsible for administration and enforcement of CERCLA (and other environmental statutes and regulations), and with final approval authority for the selected alternative.

Virginia Department of Environmental Quality (VDEQ): The Commonwealth agency responsible for administration and enforcement of environmental regulations.

Volatile organic compound (VOC): A compound that easily vaporizes and has low water solubility. Many VOCs are manufactured chemicals such as those associated with paint, solvents, and petroleum.

Please Print or type your comments here

Mark Your Calendar for the Public Comment Period

Public Comment Period

May 5, 2014 through June 18, 2014

Submit Written Comments

The Navy will accept written comments on this Proposed Plan during the public comment period. To submit comments or obtain further information, please refer to the names and contact information included at the end of Section 7. A blank sheet has been added at the end of this document to be used for writing comments

Attend the Public Meeting

May 15, 2014 at 3:30 p.m.

Yorktown Public Library
8500 George Washington Memorial Highway
Yorktown, Virginia

The Navy will hold a public meeting to explain the Proposed Plan. Verbal and written comments will be accepted at this meeting.

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Place stamp here

NAVFAC Mid Atlantic
Attention: Mr. Jim Gravette
9742 Maryland Avenue
Bldg. N-26, Room 3208
Norfolk, VA 23511-3095